types (primarily oaks), 27 percent by mixed yellow pine-oak types, another 15 percent by hemlocks and hardwoods, and 11 percent by white pine and hardwoods. The remaining types, such as alluvial forest and rock outcrops, are much less common.

Table 3.2-2 Comparison Of Ecological Type Abundance On NFS Lands Within The Chattooga River Watershed And The Upper And Lower Wild And Scenic River Corridors.

Ecological Types	USFS Acres	% on USFS	Upper Corridor (USFS Ac)	% Upper Corridor	Lower Corridor (USFS Ac)	% Lower Corridor
High Elevation Red Oak Forest	1183	1%	23	0.4%	0	0%
Montane Oak-Hickory Forest	7156	6%	155	2%	0	0%
Montane White Oak Forest	828	1%	13	0.2%	0	0%
White Pine/Heath Forest	14127	11%	1248	19%	361	4%
Mesic Oak-Hickory Forest	20554	16%	636	10%	1671	18%
Table Mountain Pine-Oak/Heath Forest	168	0.1%	0	0%	0	0%
Pitch Pin-Oak/Heath Forest	13561	11%	921	14%	710	8%
Acidic Cove Forest	4951	4%	423	6%	1735	18%
Eastern Hemlock/ Rhododendron maximum Forest	14005	11%	679	10%	24	0.3%
Alluvial Forest/Island/River Bar	1217	0.2%	156	2.4%	573	6%
Chestnut Oak/Northern Red Oak/ Rhododendron	4548	4%	486	7%	275	3%
Chestnut Oak/Scarlet Oak/Heath Forest	8275	7%	490	7%	157	2%
Dry Oak-Hickory Forest	14862	12%	1032	16%	498	5%
Shortleaf Pine-Southern Red Oak-Blackjack Oak Forest	6316	6%	9	0.1%	401	4%
Shortleaf Pine-Southern Red Oak Forest	13531	11%	141	2%	2773	29%
Heath Bald	347	0.3%	0	0%	0	0%
Swamp Forest/Bog	84	0.1%	0	0%	0	0%
Rock Outcrops	178	0.1%	0	0%	0	0%
Water	400	0.3%	117	2%	264	3%
Totals	126291		6531		9444	

Acres approximate +/- 5%.

2. Plants Associated with the Biology ORV

Several plant species were identified in the description of the biology ORV in the Sumter 2004 LRMP. All the listed species were Southern Appalachian endemics that were rare at the time of designation. A description of the habitat and status for each of the eight species or groups follows (Table 3.2-3). If the species is a PETS or locally rare plant species, it is described further in the PETS section.

Table 3.2-3. Plants Associated With The Biology ORV For The Chattooga WSR Corridor.

Species	Species Ranking		Forest List (Sites)*	Range and Habitat
	Global	State		
Pink shell azalea *Rhododendron vaseyi*	G3	S3 (NC)	NNF (15)	NC endemic present in the Chattoogo River watershed but never documented within the wild and scenic river corridor. Occurs in high elevations from closed canopy Northern Hardwood forests to partially open areas including seeps, boulderfields, meadows, and Southern Appalachian bogs.
Divided leaf ragwort *Packera millefolium*	G2	S2 (NC) S1 (GA) S2 (SC)	NNF (6) CONF (1)	Southern Appalachian endemic (NC, SC, and GA). Occurs in high elevation granitic domes and montane cedar woodlands.
Fraser's loosestrife *Lysimachia fraseri*	G2	S2 (NC) S1S2 (GA) S1 (SC)	NNF (35) CONF (9) SNF (50)	Mountains of NC, SC, and TN. Habitats include acidic cove forest, mesic oak-hickory forest, montane oak-hickory forest, dry oak-hickory forest, wet rock outcrops and river rocky shoals and islands. [See further analysis in the PETS section.]
Blue Ridge bindweed *Calystegia catesbiana ssp. Sericata*	G3	S3 (NC) S1 (GA) SNR (SC)	NNF (48) CONF(12)	Carolinas and GA to the FL panhandle. Habitats are all early seral from meadows, openings in Oak-Hickory forests, roadside edges to open rock outcrops.
Biltmore sedge *Carex biltmoreana*	G3	S3 (NC) S1 (GA) S1 (SC)	NNF (13) SNF (1)	Narrow Southern Appalachian endemic ranging within a 100-kilometer area from Brevard, NC to northwestern SC and northeastern GA. Habitat is restricted to rock outcrops either in woodlands or granitic domes.
Manhart's sedge *Carex manhartii*	G3G4	S3 (NC) S2 (GA) S2 (SC)	NNF (65) CONF (6)	Northern GA and eastern TN to southwestern VA and southern WV. Habitats include mesic areas ranging from coves to oak and hickory dominated forests.
Rock gnome lichen *Gymnoderma linerae*	G2	S2 (NC) S1 (GA) S1 (SC)	NNF (13) GA (1)	NC mountains with peripheral populations in the mountains of TN, GA and SC. Occurs on sloping to vertical rock faces with some seepage at higher elevations, generally above 5000 feet.
Liverworts				Known to be diverse across the watershed but no comprehensive survey has been conducted.

* Number of sites listed for respective national forest if the species is present and tracked as rare by the national forest.

Liverworts are known to be diverse across the Chattooga River watershed; however, no comprehensive survey has been conducted. Based on current documentation of rare liverworts, diversity is greater in the Chattooga River watershed than four adjacent escarpment watersheds. Table 3.2-4 lists the number of rare liverworts known to occur within the upper Chattooga corridor. Suitable habitat for the majority of the rare liverwort species is most prevalent in the Chattooga Cliffs and Ellicott Rock reaches and decreases in the Rock Gorge and Nicholson Fields reaches.

Table 3.2-4. Rare Liverwort Species Documented Within Different Reaches Of The Main Stem Of The Upper Chattooga River.

Reach	Regionally Sensitive Liverworts	Locally Rare Liverworts
Chattooga Cliffs	10	1
Ellicott Rock	11	0
Rock Gorge	4	0
Nicholson Fields	0	0

3. Management Indicator Species

MIS serve as the system to monitor forest plan implementation and effects on diversity and population viability of all native and desirable non-native plants and animals. At the project scale, MIS are used to assess the effects of proposed activities on habitat types. When these effects are evaluated within a forest-wide context, it is determined whether or not any trends for MIS would change. An assessment of habitat changes linked to MIS is documented in this section. Of the three forests, only the Nantahala has any MIS plants (four). The animal MIS are discussed in sections 3.2.2 and 3.2.3. Table 3.2-5 identifies the four plant MIS and the biological communities they represent.

Table 3.2-5. Biological Communities And Associated MIS For The NNF

Biological Community	MIS Plant	Analyzed Further/Evaluation Criteria*
Fir dominated high elevation forests	Fraser fir	No further analysis/1
Northern hardwood forests	Ramps	No further analysis/1
Carolina hemlock bluff forests	Carolina hemlock	No further analysis/1
Rich cove forests	Ginseng	Yes - further analysis/2

*1 Biological community and its represented species do not occur in the activity area; therefore, this biological community will not be affected. Given no effects to the community, the alternatives will not cause changes to forest-wide trends or changes in population trends of species associated with this community.

*2 Plant species seen along the access trail; however, optimal suitable habitat for this species is not present within the activity area.

All plant MIS potentially affected by project activities were initially evaluated. Information about forest-wide MIS habitats and population trends is contained in the forest MIS report**,** *"Management Indicator Species Habitat and Population Trends,"* which is available for review by contacting the Nantahala National Forest. In surveying for the Chattooga River recreation management proposal, one MIS plant, American ginseng (*Panax quinquefolius*), was located along the northernmost access trail (Chattooga Trail) off Whiteside Cove Road. While this species was located within North Carolina along a single trail, the optimal habitat for this medicinal herb was not seen within the proposed activity area.

The estimated population trend for American ginseng is gradually decreasing across the Nantahala and Pisgah national forests, primarily due to commercial harvest, both legal and illegal. Its preferred habitat is rich cove forest with high soil nutrients and calcium content. Ginseng population sizes are limited for this species within the Southern Appalachians, generally with fewer than 50 individuals (Kauffman personal observation 2006). Populations are small because of annual harvest pressure and less suitable habitat with higher base content. Within the Chattooga corridor, habitat is very limited since most sites have acidic soils with limited nutrients and are marginal for American ginseng.

4. PETS and Locally Rare Plants

All federally threatened or endangered plant species, regional forester's sensitive plant species, and locally rare plant species that occur or could occur on the NNF, CONF or SNF were initially considered in this botanical analysis. Both the NNF and CNF maintain a locally rare list while the SNF does not. Regionally sensitive species are believed to have viability concerns throughout the Southern Region and generally exhibit a global rank of G3 or T3 or lower or a national rank of N3 or lower. The regionally sensitive list was last updated in 2001. Forest concern plant species are less globally restricted but typically grow at the periphery of their range or disjunct from their main range.

Some locally rare (forest concern) species habitat types may occur within other portions of the three national forests, but not within the Chattooga River watershed. Even though locally rare species or their habitat types may be quite common in the main portion of their range, they can be rare, even rarer than sensitive species, within individual forests.

Eleven federally-listed (five threatened and six endangered), 139 sensitive and 228 locally rare plant species occur or could occur on these three forests. Of these 378 plants, 100 (one endangered species, two threatened species, 46 sensitive species, and 51 locally rare species) are known to occur on one of these three national forests where they are tracked as rare within the Chattooga River watershed.

NC Natural Heritage Program Element Occurrence (EO) records, Georgia Non-game Conservation Section EO records, South Carolina Department of Natural Resources EO records, U.S Fish and Wildlife Service species recovery plans, NatureServe© (2007) web applications and scientific literature were reviewed to determine the distribution, abundance and habitat requirements of species included in the analysis. A field survey was completed from mid-August to early October, 2007. The rare species located in 2007 were added to other previous documented survey information. A geographic information system was used to examine the distribution of EOs on the three forests and general vicinity. These records and distribution maps were reviewed to determine areas of known populations of rare plant species within the proposed project area and serve as the best available science. Based on these sources, the potential affected rare plant species list for the upper Chattooga River project was filtered to derive those species with the greatest likelihood of occurrence. Species were eliminated based on range information, such as only occurring at higher elevations in the North Carolina or Georgia mountains or in the foothills or piedmont at lower elevations in South Carolina or Georgia.

Other species were excluded from further analysis because habitat is marginal. In addition, some species were eliminated if the project area is outside their current known range and if searches in the project area did not locate any populations in potential habitat.

Finally, species were eliminated from further analysis if they were known to occur within the project area but unlikely to be impacted by any project activities (category 3). For instance *Macrocoma sullivantii, Cheilolejeunea evansii,* and *Drepanolejeunea appalachiana* are known to occur on the bark of hardwood trees and have been documented near the Chattooga River in NC and/or SC depending on the individual species (Davison et al. 1996). However all three typically occur on the bark of older deciduous trees and are unlikely to be impacted by any

alternative. Other rare species such as *Packera millefolium*, *Carex biltmoreana* and *Huperzia appressa* are known to occur in nearby rock outcrops, but they are either undetectable from the river or at a height on almost vertical rock that is essentially inaccessible to anyone except rock climbers. Forest herbaceous species, such as *Isotria medeloides*, *Monotropsis odorata*, *Carex woodii* and *Carex communis* var. *amplisquama*, which do not occur under dense rhododendron maximum thickets or adjacent to larger river channels and are therefore unlikely to be impacted by portage trails next to the Chattooga River, were also excluded. Species such as *Hymeophyllum tayloriae*, *Huperzia porophila*, *Pellia appalachiana* and *Aneura sharpii* are only known to occur in grottoes or overhangs near waterfalls. These four species were not located during the 2007 survey or prior surveys within easily accessible microsites that would tend to invite exploration by recreationists.

The final filtered list of species that occurs within the Chattooga River corridor and might be affected by one of the eight alternatives includes one federally endangered species, 13 sensitive species and 14 locally rare species. A current assessment of the existing condition for each of these species follows.

Federally Listed Plants

Rock gnome lichen (*Gymnoderma lineare*) is a Southern Appalachian endemic primarily occurring in the North Carolina mountains with peripheral populations in the mountains of Tennessee, Georgia and South Carolina (Weakley 2007). It was listed as federally endangered in the Federal Register in 1995 (U.S. Fish and Wildlife Service 1995). Threats to the species include heavy recreational use from trampling, air pollution and logging resulting in modification of the local microclimate and inappropriate collecting (U.S. Fish and Wildlife Service 1995).

Within the Chattooga River watershed, *Gymnoderma lineare* is currently only documented in the wild and scenic corridor in NC, occurring on boulders within Scotsman Creek, Fowler Creek and a newly discovered site along the main stem of the Chattooga just upstream of the NC/SC/GA border. The populations on Fowler Creek and the east bank of the Chattooga River represent the lowest elevation (approximately 2,240 feet) located for the species across its range. There is no visible impact to the populations from any current recreational usage. These conclusions are based on the observations of the interdisciplinary team forest botanist at this site, in comparison to other *Gymnoderma* sites (more than 20 sites) across its narrow range. The BA and EA indicate all the action alternatives are unlikely to adversely affect the species.

Regionally Sensitive Plants

Table 3.2-6 describes the 13 regionally sensitive plant species that occur within the Chattooga River corridor and might be affected by the alternatives.

Table 3.2-6. Regionally Sensitive Plant Species Within The Chattooga River Corridor That Could Be Affected By Any Of The Alternatives.

Species	Species Ranking Global	State	Forest List (Occurrences)	Range and Habitat
Acrobolus ciliatus	G3?	S1 (NC) SNR (GA) SNR (SC)	NNF (5) SNF (1)	Southern Appalachians within the Carolinas, TN, and GA. Humid or moist rocks in steep gorges or shaded outcrops.
Cephalalozia macrostachya ssp. *australis*	G4T1	S1 (NC)	NNF (1)	NC within Linville Gorge and Chattooga Gorge. Crevices of streamside rocks.
Hydrothyria venosa	G4	S3 (NC)	NNF (over 65)	Western NC, Va, Pa, southeastern Canada and Pacific Northwest. Aquatic lichen generally found attached to rocks partially submerged on the edge of swift-flowing, steep-gradient streams.
Lejeunea bloomquistii	G1G2	S2 (NC) S1 (GA) S1 (SC)	NNF (2) CONF (1)	KY, TN, Carolinas, and GA. Typically occurs on horizontal rock, dry, and in partial sun.
Lophocolea appalachiana	G1G2Q		NNF (7) CONF (1)	KY, TN, and Carolinas. Typically occurs on shaded wet rocks or seeps.
Fraser's loosestrife *Lysimachia fraseri*	G2	S2 (NC) S1S2 (GA) S1 (SC)	See table 3.2.2, 21 sites within the Chattooga corridor	Mountains of NC, SC, TN, and GA, disjunct to Al, Ky, and Il. Found in a variety of habitats including acidic cove forest, mesic oak-hickory forest, montane oak-hickory forest, dry oak-hickory forest, wet rock outcrops, and river rocky shoals and islands.
Marsupella emarginata var. latiloba	G5T1T2	S1 (NC)	NNF (2) Includes 1 site in upper Chattooga	NC and VT. Typically occurs within damp shaded rock outcrops.
Plagiochila austinii	G3	S1S2 (NC) SNR (GA)	NNF (5) 1 occurrence near Chattooga Bluffs; -	GA, NC and TN north to VT and Nova Scotia. Typically in damp shaded rock outcrops; occasionally associated with Spray Cliffs.
Plagiochila caduciloba	G2	S2 (NC) S1 (GA) S1 (GA)	NNF (13) CONF (1) SNF (1)	KY, TN, NC, GA, and SC. Shaded damp rocks on vertical rock walls or undersides of ledges; occasionally associated with spray cliffs.
Plagiochila sharpii	G2G4	S2 (NC) S1? (GA) S1 (SC)	NNF (8) CONF (2) SNF (1)	Southern Appalachian mountains of TN, NC, GA, and SC. Wet boulders and outcrops in river gorges.
Plagiochila sullivantii var. sullivantii	G2T2	S2 (NC) SH (GA) S? (SC)	NNF (4) CONF (1?)	WV south to the Carolinas. Deeply shaded overhung rock walls and ledges within gorges; can be associated with spray cliffs and shaded rock outcrops.
Carolina star moss *Plagiomnium carolinianum*	G3	S2 (NC) S2? (GA) S1 (SC)	NNF (3) CONF (4) SNF (1)	TN, NC, GA, SC. Wet, dripping rocks with a thin soil layer or wet humus in seepage areas.

Species	Species Ranking Global	State	Forest List (Occurrences)	Range and Habitat
Radula sullivantii	G3	S2 (NC) SNR (GA) SNR (SC)	NNF (15) CONF (5) SNF (6)	Northern SC, northeastern GA, western NC and eastern TN. Locally abundant within escarpment gorges on shaded rock outcrops near streams and rivers, most abundantly collected rare liverwort in 2007 survey,

Locally Rare Plant Species

Table 3.2-7 describes the 14 locally rare species that occur within the Chattooga River corridor and might be affected by the alternatives.

Table 3.2-7. Locally Rare Plant Species Within The Chattooga River Corridor That Could Be Affected By Any Of The Alternatives.

Species	Species Ranking Global	State	Forest List (Occurrences)	Range and Habitat
Sword moss *Bryoxiphium norvegicum*	G5?	S1 (NC)	NNF (2)	Widely distributed across the U.S but very rare across eastern states. Shaded moist rocks on ledges or sometimes overhanging water.
Blue Ridge bindweed *Calystegia catesbiana ssp. sericata*	G3	S3 (NC) S1 (GA) SNR (SC)	NNF (48) CONF (12)	Carolinas and GA to the FL panhandle. Historically distributed within xeric openings in upland forests or associated with outcrops. Typically restricted to roadside edge, powerlines, or trails.
Manhart's sedge *Carex manhartii*	G3G4	S3 (NC) S2 (GA) S2 (SC)	In Chattooga corridor NNF (4) CONF (1) SNF (2)	Northern GA and eastern TN to southwestern VA and southern WV. Habitat ranges from moist montane oak-hickory forest to rich cove forest and open acidic cove forest.
Chiloscyphus muricatus	G5	S1 (NC)	NNF (2)	NC and TN. Rock outcrops within humid gorges.
Ephebe solida	G3G4	S1 (NC)	NNF (8)	Quebec south to NC, GA, and AL. Aquatic lichen that adheres to rocks.
Lime homalia *Homalia trichomanoides*	G5	S1 (NC)	NNF (3)	WA, WI, MI, and VT south to TN and NC. Within outcrops in humid gorges or spray cliffs.
Seep rush *Juncus gymnocarpus*	G4	S3 (NC S2S3 (GA) SNR (SC)	CONF (16)	Eastern PA south to eastern TN, northeastern GA, and northern SC. Abundant across escarpment gorges.
Kidneyleaf twayblade *Listeria smallii*	G4	S4 (NC) S2 (GA) SNR (SC)	CONF (1)	PA south to TN, GA, and SC. Occurs in mesic hemlock forest typically underneath rhododendron thickets.
Climbing fern *Lygodium palmatum*	G4	S3 (NC) S2 (GA) S1S2 (SC)	CONF (2)	MA west to MI south to KY, MS, and FL. Moist thickets, islands, and bogs.

Species	Species Ranking Global	State	Forest List (Occurrences)	Range and Habitat
Pohlia lescuriana	G4?	S1? (NC)	NNF (2)	Nova Scotia to WI south to NJ, TN, and NC. Wet soil in open areas and on the banks of streams or ditches.
Bog stitchwort *Stellaria alsine*	G5	S1 (G5)	NNF(3)	Quebec south to OH, TN, and FL. Within riparian zones, seeps, and bogs.
Mountain camellia *Stewartia ovata*	G4	S2 (NC) S3 (GA) S2 (SC)	NNF (6)	VA and KY south to MS and FL. Acidic bluffs typically in rhododendron thickets.
Appalachian bristle fern *Trichomanes boschianum*	G4	S1 (NC) S1 (GA) S1 (SC)	NNF (5) CONF (3) SNF (2)	OH and WV south to the Carolinas. Vertical or overhanging rock outcrops, usually in deeply shaded grottos.
Dwarf filmy fern *Trichomanes petersii*	G4G5	S2 (NC) S2 (GA) S2 (SC)	NNF (6) CONF (2) SNF (3)	Western NC and eastern TN south to FL and LA and north to AR and IL. Vertical faces of acidic rocks; typically on drier rocks within humid gorges.

EXISTING IMPACTS TO THE ENVIRONMENT

Current recreation use in the upper corridor is causing numerous areas of vegetation damage including trampling and clearing of vegetation around campsites, erosion and loss of plants along user-created trails, damaged trees and bare banks at stream crossings. Existing impacts to rare species from current use are unknown. In addition, the loss of eastern hemlocks from HWA is occurring; this loss is expected to become even more prevalent in coming years. While hemlocks occur across most of the 21-mile stretch of the upper corridor, they are much more abundant in the Chattooga Cliffs and Ellicott Rock reaches. Table 3.2-8 shows the relative density and distribution of hemlocks among the primary reaches of the upper Chattooga.

The ongoing decline will result in continued changes in species composition, structure, and microclimate along with likely increases in downed trees and LWD in the river. Downed logs that span the river create log jams that may cause recreationists on the river to go over, under or around them. If they go around the obstacles, this action can create user trails and vegetation trampling. The amount of LWD currently on the upper corridor is displayed in Figures 3.2-1 and 3.2-2 (in Section 3.2.3 Aquatic Species and Habitat).

Trampling of vegetation is a concern in high-use areas around bridges and popular frontcountry fishing and recreation locations which are expected to continue to attract users (see table 3.3-1 on page 96 for definition of “frontcountry”). However, impacts are even more of a concern in the upper reaches of the corridor where rare plant species and a greater density of hemlocks are more commonly found.

Eastern hemlocks primarily occur within two community types, both of which dominate the main stem of the Chattooga River. Hemlock hardwood forests are dominated (50-75%) by eastern hemlocks while acidic cove forests are typically dominated by hardwoods with thirty percent or less canopy dominance by eastern hemlock. Table 3.2-8 shows the relative density and distribution of these two community types among the primary reaches of the upper Chattooga.

Table 3.2-8. Eastern Hemlock Communities Within Different Reaches Of The Main Stem Of The Upper Chattooga River

River Reach	River Segment	Hemlock-Hardwood % Adjacent to River	Acidic Cove % Adjacent to River
Chattooga Cliffs	Grimshawes Bridge south to Bull Pen Bridge	86%	0%
Ellicott Rock	Bull Pen Bridge south to Ellicott Rock	65%	0%
	Bull Pen Bridge south to East Fork	59%	0.1%
	Bull Pen Bridge south to Burrells Ford	54%	0.3%
Rock Gorge	Burrells Ford south to Lick Log	1%	64%
Nicholson Fields	Lick Log south to Highway 28	0.2%	33%

ENVIRONMENTAL CONSEQUENCES

The primary effects on vegetation from the proposed alternatives are: trampling of plants, scraping plants off rocks, and increased introduction of non-native invasive plants.

For assessment purposes, the upper Chattooga River corridor (above the Highway 28 bridge) is used as the analysis boundary to examine the direct and indirect effects that each alternative may have on vegetation. The cumulative effects analysis area will vary in size based on species distributions and foreseeable future actions. Refer to Table 3.1-9 for a listing of past, present, and reasonably foreseeable actions within the Chattooga River watershed.

1. Ecological Communities – Direct, Indirect and Cumulative Effects

The primary impacts of the proposed actions would be on riparian communities including eastern hemlock-hardwoods, acidic cove, alluvial forest, alluvial island and rocky shoals. The communities are defined in the document "Community Descriptions" located in project file. None of the alternatives would result in loss of a plant community. While these plant communities may be directly and indirectly affected by the proposed recreational alternatives, the loss of hemlocks will potentially have a greater effect on both species composition and structural diversity (Ford and Vose 2007). The loss of hemlock will occur regardless of the selected alternative.

Alternatives that attract more users to the remote upper stretches of the river increase the likelihood of portage needs and trampling of vegetation, although the degree of potential impacts varies by anticipated use levels. Although impact levels are difficult to quantify, it is likely that effects would be greatest under alternatives 8, 9 and 10 which have the fewest user restrictions; followed by alternatives 4 and 5. Comparative effects under alternatives 4 and 5 are difficult to distinguish since Alternative 4 has greater flow restrictions, a shorter boating season and fewer boaters than Alternative 5 which allows more boating over a year-long season but covers fewer reaches. Implementation of Forest Service monitoring to check for log jams and analyze and manage portage needs would help minimize effects under all the alternatives (see Appendix B for monitoring plan).

Another potential impact on ecological communities would be the continued introduction of additional non-native invasive plant species (NNIS plants) from visiting recreation users. NNIS plant species observed throughout the riparian areas of the river corridor include *Microstegium*

vimineum, Paulownia tomentosa, Pueraria lobata, Ailanthus altissima, Rosa multiflora, Ligustrum sinense, Dioscorea polystachya, Miscanthus sinensis, Lespedeza bicolor, L. cuneata, Lonicera japonica, Albizia julbrissin and *Elaeagnus umbellulata*. Generally, most outbreaks were small and did not dominate any one plant community. An exception is the large open field just north of Highway 28 which has a large outbreak of numerous invasive species.

NNIS plants tend to be more frequent within riparian areas and increase with greater flood frequency (Brown and Peet 2003). NNIS tend to be associated with disturbance that exposes soils and thereby creates conditions for plants to become established. Any additional recreation users within the upper portions of the Chattooga River have the potential for introducing new outbreaks or new NNIS plants to the riparian corridor. However, this should be limited to small selected areas, primarily islands in the lower reaches of the upper corridor, given the dense mass of *Rhododendron maximum* in the shrub layer, which tends to impede establishment of NNIS plants. Acidic cove forests and eastern hemlock forests with *Rhododendron maximum* were found to have the lowest number of outbreaks in an inventory completed across selected watersheds in the Nantahala and Pisgah national forests (Kauffman personal observation 2007). Based on an evaluation of existing vegetation conditions, past inventories in similar areas and low levels of disturbance, invasive species are not expected to increase as a result of boating .

Ground-disturbing activities, including timber harvest, road construction and prescribed burning, have the potential to cumulatively introduce non-native invasive plants. The additional introductions of NNIS plants from recreation use in the upper Chattooga would be additive to non-native introductions that occur as a result of other management activities. Projects to remove non-native invasives, such as the one planned for Sarah's Creek Campground, would subtract from these additions. However, it is likely that a net increase in introductions of NNIS plants would occur over time under any of the alternatives. Alternative 2 would result in the fewest new introductions since it is designed to restrict the number of recreationists to a lower level than at present.

2. Plants Associated with the Biology ORV – Direct, Indirect and Cumulative Effects

Seven plant species, and liverworts as a group, were identified as outstanding remarkable values in the description of the biology within the Chattooga River watershed when the wild and scenic river corridor was designated. All the identified species included southern Appalachian endemics that were rare at the time of designation. Updated distribution information has determined a few of the species (*Carex manhartii, Carex biltmoreana,* and *Calystegia catesbiana var. sericata*) are not as seriously threatened now as previously determined at the time of wild and scenic designation. There was no clarification on species within the liverwort group.

The following discussion addresses direct, indirect and cumulative effects on each of the eight plant species associated with the biology ORV for the Chattooga wild and scenic river corridor.

Pinkshell Azalea (*Rhododendron vaseyi*)
Though documented in the Chattooga watershed, pinkshell azalea has never been documented in the wild and scenic river corridor. Therefore, none of the alternatives is likely to directly, indirectly or cumulatively affect this species.

Divided Leaf Ragwort (*Packera millefolium*)
This population occurs within a steep granitic outcrop approximately 300 to 500 feet above the narrow confines of Chattooga Cliffs. Presently this area receives very little visitation due to the inaccessibility of the site. Boaters would float by this area of the river with *Packera millefolium* upslope in alternatives 4, 8, 9 and 10. However, due to the steep terrain, it is doubtful that any users would be visiting this site. As such, this species was excluded from any further analysis. None of the alternatives is likely to directly, indirectly or cumulatively affect this species.

Fraser's Loosestrife (*Lysimachia fraseri*)
Impacts to the species have been noted from road widening projects, herbicide use and road grading (Kauffman personal observation). Fraser's loosestrife is a Forest Service Region 8 sensitive plant. Further analysis has been completed for Fraser's loosestrife within the PETS effects section of this document.

Blue Ridge Bindweed (*Calystegia catesbiana ssp. sericata*)
All alternatives call for a review and possible closure of user-created trails that are unsustainable. Closure of a steep user-created trail off Bull Pen Road approximately one mile east of the bridge could result in less suitable habitat for this species within the white pine-heath community; however, this population is expected to persist surrounding the large opening on the toe ridge next to Bull Pen Road. The anticipated use in any of the alternatives may affect some individuals but will not result in the loss of sites and therefore populations should remain stable. This species is also addressed in the locally rare section of this document.

Biltmore Sedge (*Carex biltmoreana*)
Alternatives 4, 5, 8, 9 and 10 all allow boating where at least one of the three separate populations occurs 20 to 500 feet upslope on vertical to steep rock outcrops either within the Chattooga Cliffs reach or the Rock Gorge reach. However, due to the steep terrain it is doubtful that users would be tempted to visit and possibly impact individuals. For this reason, this species was excluded from any further analysis. None of the alternatives is likely to directly, indirectly or cumulatively affect this species.

Manhart's Sedge (*Carex manhartii*)
Many rare plant species are revisited once or twice every five to seven years and typically only non-quantitative data is collected. As a result impacts are usually inferred from anecdotal information. This species was formally dropped from the regional sensitive list in 2001 with updated information from the NNF where more than 65 populations were documented during the 1990s. As a result both the NNF and the SNF no longer formally tracked this sedge. Manhart's sedge is particularly abundant from west to east of the Chattooga River watershed in the upper Little Tennessee River watershed and the Thompson and Whitewater river watersheds, respectively (Natureserve 2007, G. Kauffman, personal observation).

Current use is most likely not greatly impacting this species. An individual plant could be trampled if it occurs next to a trail. Direct impacts, such as digging or crushing individuals, could occur with construction of new campsites and/or relocation of inappropriate trails under any of the action alternatives. Any future decisions could include mitigation measures to protect these species if any rerouting of existing trails is needed. In addition, slightly more impacts could

occur in Alternative 5 as boaters take out at Lick Log Creek, where a new population was documented in 2007. This species is also addressed in the locally rare section of this document.

Rock Gnome Lichen (*Gymnoderma lineare*)
Further analysis for this lichen is detailed in the PETS section.

Liverworts
Existing recreational use, including negative impacts such as trampling as users traverse the river, could be affecting these rare species. These impacts are probably minimal since the optimal suitable habitat for the rare liverworts is in more remote portions of the corridor that receive little visitation. The ongoing death and toppling of surrounding eastern hemlocks within the forested canopy are anticipated to result in negative impacts either by directly crushing individuals or indirectly modifying humidity and light levels. However, the dense *Rhododendron maximum* shrub layer throughout the Chattooga River gorge may lessen these microclimate effects.

Alternatives 4, 5, 8, 9 and 10 could increase negative impacts to the rare liverworts if large numbers of portage trails are required. The level of impact is difficult to predict and would vary based on the location and density of log jams and the level of use. Potential impacts to liverworts are anticipated to be greater in the uppermost portion of the corridor since habitat is more suitable here, the river is narrower and a higher density of hemlocks occurs here, many of which are already dead. Adverse cumulative impacts from other activities are unlikely given the remote habitat areas occupied by the species.

Table 3.2-9 compares the potential impacts to liverworts by each of the alternatives. A more complete analysis for rare liverwort species is detailed in the PETS analysis.

Table 3.2-9. Risk Analysis And Anticipated Impacts To Rare Liverwort Species As A Group For The Eight Analyzed Alternatives.

Alternative	Impacts Rank	Risk Assessment
No-Action	6	3rd least impact. Existing camping/angling impacts
2	8 = least impact	Least impact overall. Anticipate reduced impacts with lower camping densities and designated campsites
3	7	2nd least impact. Slightly less impacts than no-action by limiting trails and parking
4	5	Boating alternative least impact given greatly reduced frequency with 3 month season and highest minimum flow
5	4	Boating action with second least impact since alternative excludes boating activity north of Bull Pen Bridge, however there is no seasonal restriction
8	1= greatest impact	Greatest likelihood of impacts due to all upper corridor reaches open to boating and no seasonal or flow restrictions
9	2	Impacts less than Alternative 8 since fewer boating opportunities with season and time restrictions and fewer proposed boating stretches
10	3	Impacts less than Alternative 9 since fewer boating opportunities with slightly shorter boating season

Management Indicator Species – Direct, Indirect and Cumulative Effects

None of the alternatives would change the amount of suitable habitat for American ginseng. However, it would be most impacted by Alternative 8 because it would encourage access along the Chattooga Trail off Whiteside Cove Road when ginseng would be visible. However, even if the few individuals near the Chattooga Trail were harvested when encountered, this impact would be minimal in comparison to the greater harvest intensity on the rest of the NNF.

Cumulatively, implementation of any alternative would not change the forest-wide downward trend for American ginseng populations. During the last two years, the NNF has experienced a significant increase in ginseng harvest. In 2008 the NNF permitted harvest of over 50,000 individuals. The potential harvest of individuals along the access trail to the Chattooga Trail off Whiteside Mount Road as a result of increased recreation usage would represent less than 0.01% of the permitted harvested amount.

PETS and Locally Rare Plants – Direct, Indirect and Cumulative Effects

All users potentially could affect these 28 plant species. Potential direct and indirect effects from the eight proposed alternatives include trampling while users traverse the river, trampling of vegetation within campsites and along trails, scraping of rocks from boats traversing the river at different high flows and portaging of boats around log jams which are anticipated to increase with the decline of eastern hemlock. Table 3.2-10 provides a crosswalk of potential impacts on rare species from each of the proposed alternatives.

Table 3.2-10. Potential Direct Or Indirect Effects On Rare Plants By Alternative (Organized By Type Of Effect)

Scientific Name	Forest Status	Potential Effects	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 8	Alt 9	Alt 10
Gymnoderma lineare	Endangered	Trampling/scraping on rocks on river bank[2]	No	No	No	No	No	No	No	No
Acrobolbus ciliatus	Sensitive	Trampling/scraping on rocks in river and river bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cephalozia macrostachya ssp. Australis	Sensitive	Same as above	No	No	No	Yes	No	Yes	Yes	Yes
Hydrothyria venosa	Sensitive	Same as above	No	No	No	Yes	No	Yes	Yes	Yes
Lejeunea blomquistii	Sensitive	Same as above	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lophocolea appalachiana	Sensitive	Same as above	No	No	No	Yes	Yes	Yes	Yes	Yes
Marsupella emarginata var. latiloba	Sensitive	Same as above	No	No	No	Yes	No	Yes	Yes	Yes
Plagiochila austinii	Sensitive	Same as above	No	No	No	Yes	No	Yes	Yes	Yes
Plagiochila caduciloba	Sensitive	Same as above	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plagiochila sharpie	Sensitive	Same as above	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plagiochila sullivantii var. sullivantii	Sensitive	Same as above	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plagiomnium carolinianum	Sensitive	Same as above	No	No	No	Yes	No	Yes	Yes	Yes
Radula sullivantii	Sensitive	Same as above	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bryoxiphium norvegicum	Locally Rare	Same as above	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chiloscyphus muricatus	Locally Rare	Same as above	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pohlia lescuriana	Locally Rare	Same as above	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Homalia trichomanoides	Locally Rare	Same as above	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Trichomanes boschianum	Locally Rare	Same as above	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trichomanes petersii	Locally Rare	Same as above	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lysimachia fraseri	Sensitive	Trampling on islands	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Juncus gymnocarpus	Locally Rare	Trampling on islands	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stellaria alsine	Locally Rare	Trampling on islands	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Carex manhartii	Locally Rare	Trampling from portage trails, campsites	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Listera smallii	Locally Rare	Trampling on portage trails	No	No	No	Yes	Yes	Yes	Yes	Yes
Lygodium palmatum	Locally Rare	Trampling at campsites	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Stewartia ovata	Locally Rare	Trampling at campsites	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calystegia catesbiana var sericata	Locally Rare	Impacted by trail closures (loss of early seral habitat)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ephebe solida	Locally Rare	Low Impact	No	No	No	Yes	Yes	Yes	Yes	Yes

All of the proposed alternatives are expected to have some level of effect on vegetation depending on the anticipated type, intensity and location of recreation uses. Increasing river use in sections currently infrequently visited by recreationists is likely to result in increased impacts from trampling, especially in areas with rare plant populations near or in the river. Likewise, a

[2] A determination of "Not likely to adversely affect" was made in the BA for *Gymnoderma lineare*.

high density of eastern hemlocks adjacent to the river increases the likelihood of portage needs for boaters. Impacts are expected to vary by individual rare species. However, with implementation of the monitoring guidelines, including periodic assessment of portage needs, adverse impacts would be minimized. For *Gymnoderma lineare*, it was determined during a site visit with U.S. Fish and Wildlife Service personnel (Asheville, NC and Columbia, SC offices) that the population was in a protected location which would discourage any visitation from boaters; if adjacent eastern hemlocks fell across the river here, requiring portage, the natural area to traverse would be the western bank where the species did not occur. Therefore, project activities associated with any of the five boating alternatives is not likely to adversely affect *Gymnoderma lineare*.

Alternative 1 – Direct, Indirect and Cumulative Effects

Direct effects under current management include trampling and/or manipulation of the shrub and herb layers while creating campsites and user trails in the three forests and vegetation damage while creating camp fires on islands. Existing users could also directly affect rare bryophytes and lichens by scraping occupied rocks and trampling streamside vegetation. Trampling and removal of vegetation associated with the creation of campsites and user-created trails have an indirect effect on competition among associated understory species. Species such as *Juncus tenuis* or NNIS that favor compacted soils may increase and displace rare species in the forests such as *Carex manhartii* or *Lygodium palmatum* or other rare species on the islands such as *Lysimachia fraseri*, *Juncus gymnocarpus* or *Stellaria alsine*.

Recent and future decline and death of eastern hemlock along the adjacent riparian forest have resulted in effects to rare plant species within the corridor, primarily from crushing plants and modifying the microclimate, although the latter is less evident within the deep gorge since the area is densely covered with the evergreen shrub, *Rhododendron maximum.*

Recent past activities within the upper Chattooga River watershed that may still be impacting rare plant species include prescribed burning, road reconstruction and timber management. Present ongoing activities that may affect plant species include brook trout restoration and habitat enhancement, wildlife opening maintenance, road maintenance and recreational activities. Possible future activities include prescribed burning, timber management, invasive plant management and road reconstruction in addition to the present ongoing activities.

In the past ten to 20 years, recreational use has increased on the trails and on the river within the wild and scenic corridor. The increased use has affected individual rare plant species. The recreational activities are anticipated to continue in the future in the most accessible portions of the river corridor. Recent home development, road construction and reconstruction have primarily contributed to the loss of suitable habitat for the forest-associated species and to a lesser extent to the gorge river-associated species within private property in the corridor. There have been less frequent and smaller disturbances of this habitat within public ownership areas. These cumulative effects on plants on private property are expected to continue for the foreseeable future given the high land value across the watershed.

Federally Listed Species

Gymnoderma lineare

None of the alternatives that include boating (alternatives 4, 5, 8, 9 and 10) are likely to result in trampling impacts to *Gymnoderma lineare* or to adversely affect this species. Similarly, no project activities associated with the non-boating alternatives are likely to affect *Gymnoderma lineare*. No future projects on the CONF or the NNF are anticipated to affect *Gymnoderma lineare*. Thus there are no cumulative affects anticipated on *Gymnoderma lineare* with implementation of this project for all alternatives.

Sensitive Plant Species

Thirteen sensitive plant species were identified for further analysis based on potential effects from any of the alternatives proposed for the Chattooga River recreational use project. Seven of these sensitive plant species could have individuals impacted by any one of the eight alternatives. These species occur in more accessible corridor areas and could be trampled or crushed with existing and/or increased recreational usage. These seven species are *Acrobolbus ciliatus, Lejeunea blomquistii, Lysimachia fraseri, Plagiochila caduciloba, Plagiochila sharpii, Plagiochila sullivantii var. sullivantii,* and *Radula sullivantii*.

With the exception of *Lysimachia fraseri*, none of the individuals within populations recorded for these seven species are likely to be affected by projects within the upper Chattooga River corridor, other than recreational impacts. Since these species were relocated during the field review it is suspected that existing recreation use provides enough habitat for their continued persistence in the upper Chattooga River. With increased usage, except for *Lejeunea blomquistii* and *Plagiochila sullivantii var. sullivantii*, the remaining species should be able to persist within the upper Chattooga River since they occur in both accessible and inaccessible portions of the gorge and the inaccessible portions will receive fewer impacts from all recreational users. Provided the monitoring plan is implemented for alternatives 4, 8, 9, or 10 for *Lejeunea blomquistii* and *Plagiochila sullivantii var. sullivantii*, there are no anticipated cumulative effects that will lead to further impacts on these two species within the upper Chattooga River.

For *Lysimachia fraseri*, two previous road improvement projects within the NNF have impacted habitat and directly affected individuals along Bull Pen Road and Whiteside Cove Road. Habitat conditions within these two areas are not currently suitable for *Lysimachia fraseri* and probably will not become suitable for another ten years. A long-term project to relocate individuals currently maintained in a common garden at Warren Wilson College will improve the viability of this species within the Chattooga River watershed portion of the NNF. Based on regrowth of the propagated stems, the net loss of stems from these previous projects is less than 200. The goal with the restoration project is to reestablish the species in sites with recurrent disturbance to ensure its long-term persistence. The past negative impacts and the anticipated benefits in the future will result in a slightly greater cumulative loss of individuals of *Lysimachia fraseri* with implementation of any of the Chattooga River recreation alternatives, including the no-action alternative.

Cephalozia macrostachya ssp. australis, *Marsupella emarginata var. lobata, Plagiochila austinii,* and *Plagiomnium carolinianum* could be negatively impacted with the action boating alternatives 4, 8, 9 and 10. No other projects in the past or anticipated in the future have impacted, or are likely to impact these four bryophytes.

Hydrothyria venosa, a sensitive aquatic lichen, could also be negatively impacted with the action boating alternatives 4, 8, 9, and 10. For *Hydrothyria venosa*, road construction associated with one previous vegetation management project within the Chattooga River watershed directly impacted occupied habitat and permanently removed a small portion of the population with placement of a culvert. Six other past projects may have affected occupied habitat for this species from increased sediments following disturbance from project activities. However, this effect would have been relatively short in duration and dissipated throughout the stream channel. Except for the permanent loss of a very small amount of stream habitat with the culvert, no remaining direct and indirect effects from previous projects are negatively affecting this lichen. Thus any cumulative impacts on *Hydrothyria venosa* habitat with implementation of alternatives 4, 8, 9 or 10 should be miniscule in comparison to the amount of habitat present within NC in the upper Chattooga River corridor.

Locally Rare Species

Fourteen locally rare plant species were identified for further analysis based on potential effects from any of the alternatives proposed for the Chattooga River recreational use project. Eight of these locally rare plant species could have individuals impacted by any one of the eight alternatives. As previously indicated for impacts to sensitive plant species, these locally rare plant species occur in more accessible corridor areas and could be trampled or crushed with existing and/or increased recreational usage. These eight species are *Bryoxiphium norvegicum, Calystegia catesbiana var sericata, Chiloscyphus muricatus, Juncus gymnocarpus, Stellaria alsine, Stewartia ovata, Trichomanes petersii,* and *Trichomanes boschianum.* Other than *Calystegia catesbiana var sericata* and *Juncus gymnocarpus,* recreational impacts within the Chattooga River are the only negative affects to these species. No other projects known for all these species within the upper Chattooga River are likely to affect any individuals within populations recorded for these species. Since these species were relocated during the field review it is suspected the existing recreation use provides enough habitat for their continued persistence in the upper Chattooga River. With increased usage, except for *Bryoxiphium norvegicum* and *Chiloscyphus muricatus,* the remaining species should be able to persist within the upper Chattooga River since they occur in both accessible and inaccessible portions of the gorge and the inaccessible portions will receive fewer impacts from all recreational users. Provided the monitoring plan is implemented for alternatives 4, 8, 9 and 10 for *Bryoxiphium norvegicum* and *Chiloscyphus muricatus,* there are no anticipated cumulative effects that will lead to further impacts on these two species within the upper Chattooga River.

Previous road improvement projects on the NNF have affected individuals of both *Calystegia catesbiana var. sericata* and *Juncus gymnocarpus*. For *Calystegia catesbiana var. sericata* this was only a short-term impact and no longer affects the species. There is another anticipated impact to a population on a proposed road project on the NNF. This anticipated negative impact is also expected to be short-term in duration, one to two years. For *Juncus gymnocarpus*, which

can occur in roadside seeps or ditch lines, the anticipated negative effect is still ongoing and probably will not result in suitable habitat for another ten years. *Juncus gymnocarpus* is relatively common in the NNF in the upper Chattooga River watershed. As a result it is no longer tracked as a rare species. No known projects in the past have affected this species, nor any anticipated in the future on the Chattahoochee NF.

Homalia trichomanoides and *Pohlia lescuriana* may have individuals impacted with all the alternatives except Alternative 5. *Ephebe solida* and *Listera smallii* could be impacted by any of the five boating alternatives. *Carex manhartii* and *Lygodium palmatum* could have individuals impacted by any of the five boating alternatives as well as the no-action alternative. Other than *Carex manhartii*, no other projects in the past or anticipated in the future have impacted or are likely to impact these two bryophytes and four vascular plants. *Carex manhartii* is relatively common in the NNF in the upper Chattooga River watershed. Various vegetation management and road improvement projects have impacted this species. Most of the negative impacts have been for the short term; a few have been permanent, such as new road construction for vegetation management projects. However the species is still common in the upper Chattooga River watershed in the NNF, and as a result it is no longer tracked as a rare species. No known projects in the past have affected this species, nor are any anticipated in the future on the CONF.

The cumulative effects from these past and future effects on rare plant species within the corridor are not anticipated to result in the loss of any existing species. They may, however, contribute to a reduction in population size of individual species listed in Table 3.2-10 and result in a "yes" under the column addressing Alternative 1 for those species not already being impacted.

Alternative 2 – Direct, Indirect and Cumulative Effects

Direct and indirect effects to rare species are the same as in Alternative 1 except there would be less potential for effects from new user-created trails or new dispersed campsites. Blue Ridge bindweed would be indirectly affected when the steep eroding trail off Bull Pen Road is decommissioned. The effect of limiting recreational usage would not eliminate potential direct effects to rare bryophytes in the river; however, it should reduce the frequency of adverse encounters. As result, impacts to these species would be less compared to Alternative 1.

Cumulative effects to the river-associated species would primarily be from the continued death and dropping of eastern hemlocks and effects to forest species from private property. As in Alternative 1, the cumulative effects from fallen hemlocks on rare plant species within the corridor are not anticipated to result in the loss of any existing species but may contribute to a reduction in population size of individual species listed in Table 3.2-10 and having a "yes" under the column addressing Alternative 2.

Alternative 3 – Direct, Indirect and Cumulative Effects

The direct, indirect and cumulative effects to individual species would be the same as Alternative 2. However, the frequency of impacts would be greater since the higher campsite density would potentially allow more users within the corridor on any given day. Therefore, the impacts to vegetation from this alternative are expected to be less than Alternative 1 but more than Alternative 2.

Alternative 4 – Direct, Indirect and Cumulative Effects

The same type of direct and indirect effects as detailed for Alternative 1 will occur to rare species with Alternative 4. The type of direct and indirect effects can occur for both alternatives. However, under Alternative 4, there is potentially a greater frequency of these effects. This increased frequency could result in greater population decline for affected species as more people will be using inaccessible portions of the river. As a result there could be direct effects of trampling or scraping individuals of additional rare species as displayed in Table 3.2-10. The most noteworthy effect of this alternative is the potential need for portaging, particularly in the uppermost corridor where eastern hemlocks are denser and trees are already dead. Increased portaging could directly affect rare bryophytes and lichens by trampling and crushing small individuals adhering to rocks and boulders, primarily on the river's edge, or trampling terrestrial herbaceous species. If portaging is possible in the middle of the river, potential direct effects would be greatly reduced. The majority of the rare species are on rocks at the edge of the river, not the center of the main channel. These impacts to rare bryophytes and lichens are difficult to adequately assess in terms of timing and intensity since it is uncertain how quickly and where the dead trees will fall and how large individual bryophyte populations are present within potential portage areas. The populations of rare bryophytes that were located along the river are quite miniscule. It would be difficult to determine their distribution and abundance. Based on inventories, the greatest likelihood of occurrence was identified along specific stretches of the river. The greatest potential impact to the rarest species would be from creation of portage trails. To mitigate these potential effects, periodic monitoring of log jams is required with site specific bryophyte surveys conducted when they are located.

The season and flow restrictions in this alternative will reduce the frequency of potential impacts to rare plant species in comparison to the other boating alternatives. Five sensitive species and four locally rare species are of particular concern, since all of these species have few populations (less than five) known across the individual forest, are limited within the Chattooga River watershed and typically have very small individual population sizes. The sensitive species of concern are *Lophocolea appalachiana* and *Lejeunea bloomquistii* on the CONF and *Cephalozia macrostachya ssp. australis, Plagiomnium carolinianum, Lophocolea appalachiana* and *Plagiochila sullivantii var. sullivantii* on the NNF. The locally rare species of concern are *Chiloscyphus muricatus, Homalia trichomanoide,* and *Bryoxiphium norvegicum* for NNF and *Listera smallii* for CONF. Sections of the Chattooga River were identified as having high potential for these species. The Monitoring Plan in Appendix B requires reconnaissance of large woody debris prior to the start of the boating season in these sections. If portage is deemed necessary, surveys would be made to determine the presence of these species. A site-specific NEPA decision would be made for portage trails.

Cumulative effects from existing past and future actions to the rare species affected by this alternative do not differ from any of the other alternatives except for the more widespread species *Hydrothyria venosa* which may have been affected across many more small watersheds with increased sedimentation from developments, road construction and reconstruction. The cumulative effects from these past and future effects on rare plant species affected by Alternative 4 are not anticipated to result in the loss of any existing species in the corridor.

Alternative 5 – Direct, Indirect and Cumulative Effects

Direct, indirect and cumulative effects are similar to alternatives 4, 8, 9 and 10; however, the number of rare species potentially affected by this alternative is lower since the species-rich area north of Bull Pen Road is excluded from boating. Five sensitive plant species and two locally rare species are unlikely to be affected by this alternative in comparison to alternatives 8, 9 and 10 (see Table 3.2-11). In addition, the frequency of effects would be reduced for those species (*Bryoxiphium norvegicum, Chiloscyphus muricatus* and *Trichomanes petersii)* that only occur adjacent to the river within the Chattooga Cliffs reach, as compared to other alternatives that add boating. In this alternative, two sensitive species and one locally rare species are of particular concern: *Lophocolea appalachiana* in the NNF and the CONF, *Lejeunea bloomquistii* for CONF, and *Listera smallii* for CONF. These species only have a single or a few documented small populations across each individual forest. However, full implementation of the monitoring guidelines (see Appendix B), including designating portages if necessary, should alleviate any viability concerns for these species.

Alternative 8 – Direct, Indirect and Cumulative Effects

The same types of direct, indirect and cumulative effects under alternatives 4, 5, 9 and 10 would occur to rare species under Alternative 8. However, Alternative 8 poses the greatest potential for negative impacts to rare plant species since it allows boating year-round, at all flow levels, over the entire length of the upper Chattooga River.

The same five sensitive species and four locally rare species are of particular concern as in Alternative 4. However, full implementation of the monitoring guidelines (see Appendix B), including designating portages if necessary, should alleviate any viability concerns for these species.

Alternative 9 – Direct, Indirect and Cumulative Effects

The same direct, indirect and cumulative effects would occur to all the same rare species for this alternative as Alternative 8 although the frequency of effects would be less. The same five sensitive and four locally rare plant species as identified for Alternative 8 are of particular concern from potential trampling and scraping of river bank and river rocks. However, full implementation of the monitoring guidelines (see Appendix B), including designating portages if necessary, should alleviate any viability concerns for these species.

Alternative 10 – Direct, Indirect and Cumulative Effects

The same direct, indirect and cumulative effects would occur to all the same rare species for this alternative as alternatives 8 and 9 although the frequency of effects would be less than Alternative 9 since fewer days are permitted for boating. As previously stated for Alternative 9, the same five sensitive and four locally rare plant species are of particular concern with implementation of this alternative. However, full implementation of the monitoring guidelines (see Appendix B), including designating portages if necessary, should alleviate any viability concerns for these species.